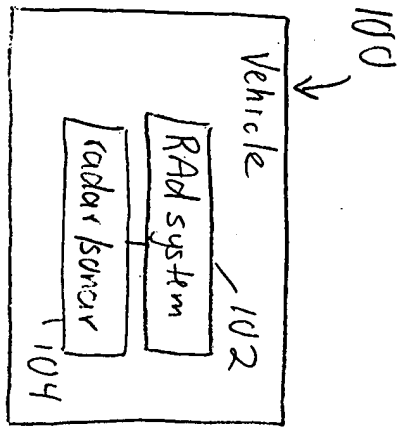
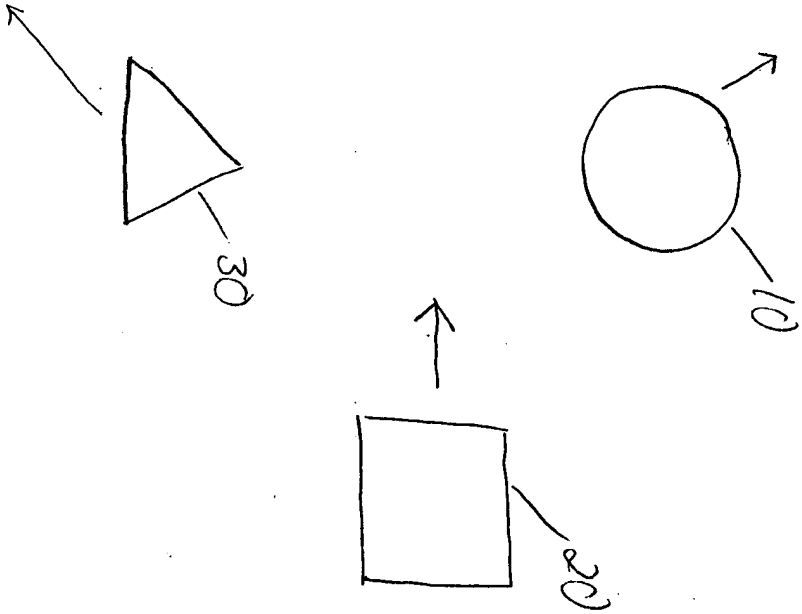


FIG. 1



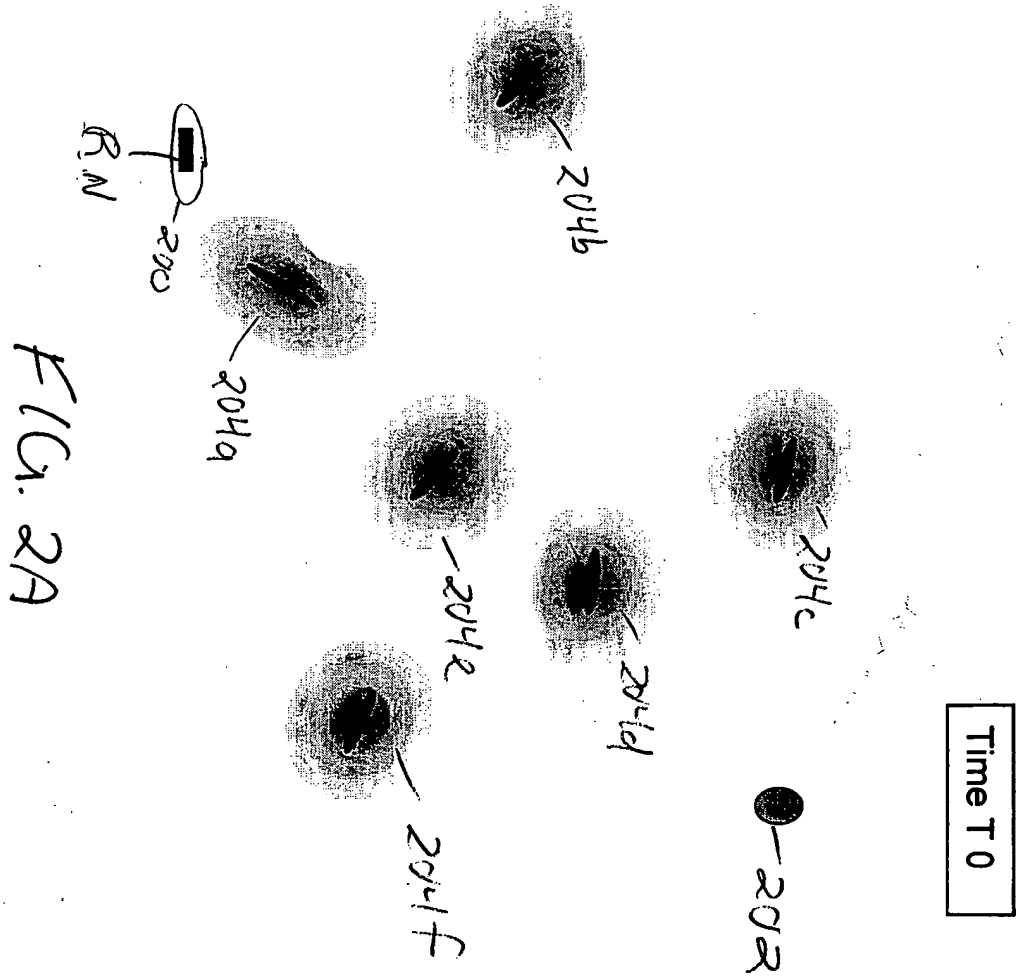


FIG. 2A

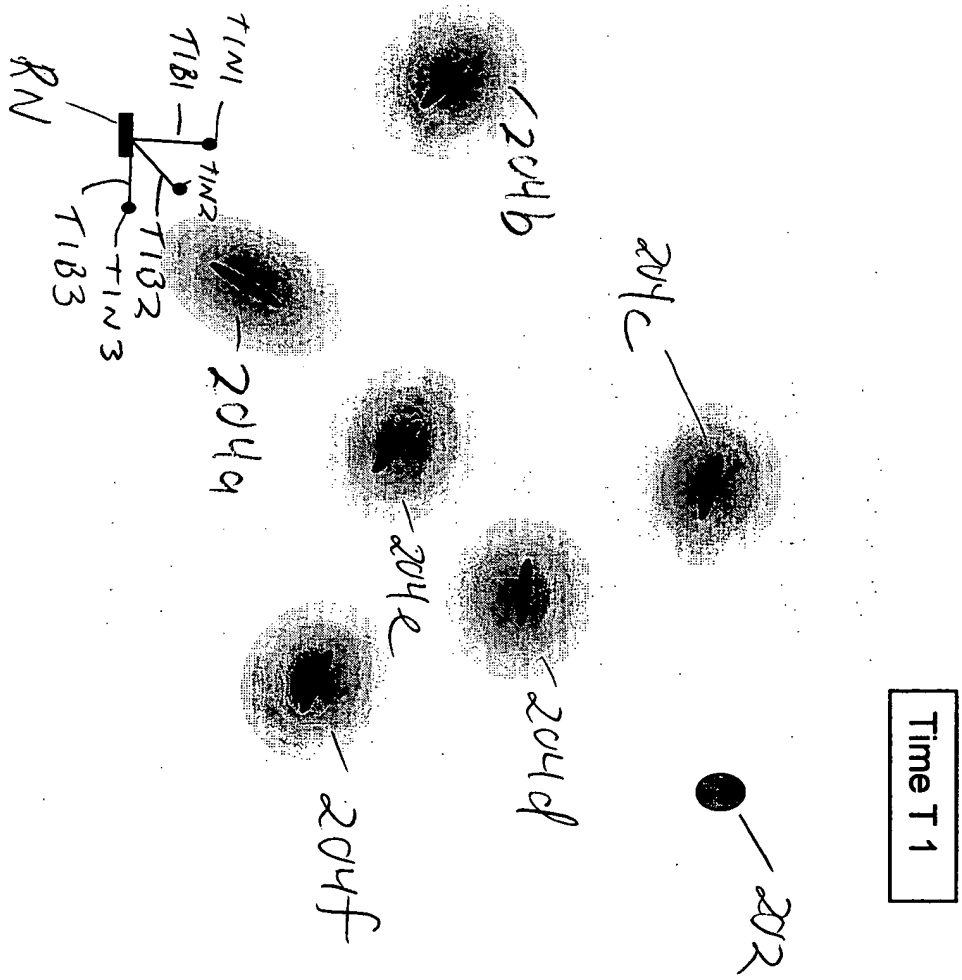

Time T 1
202
204c
204b
204a
204e
204d
204f
RN
TIN1
TIB1
TIN2
TIB2
TIN3
TIB3

FIG. 2B

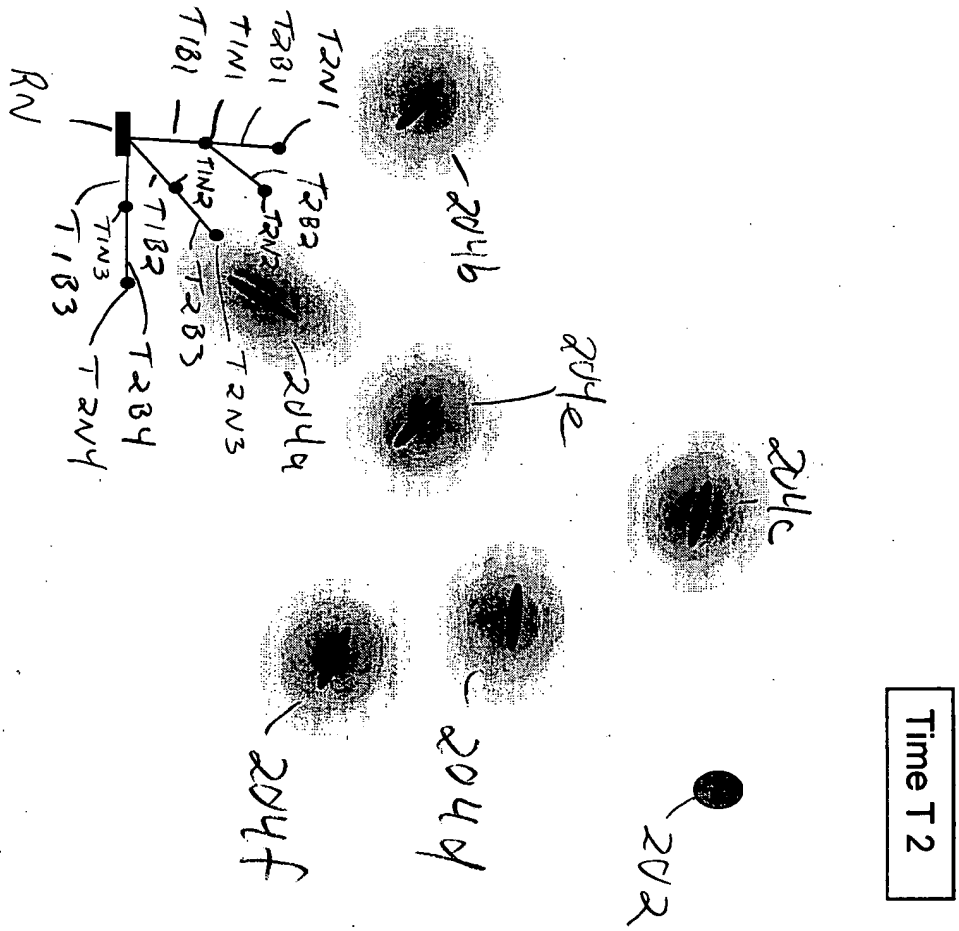

RN
T1B1
T1N1
T2B1
T2N1
T1N2
T2B2
T2N2
T1B2
T2B3
T2N3
T1N3
T1B3
T2B4
T2N4
204a
204b
204c
204d
204e
204f
202
Time T2

FIG 2C

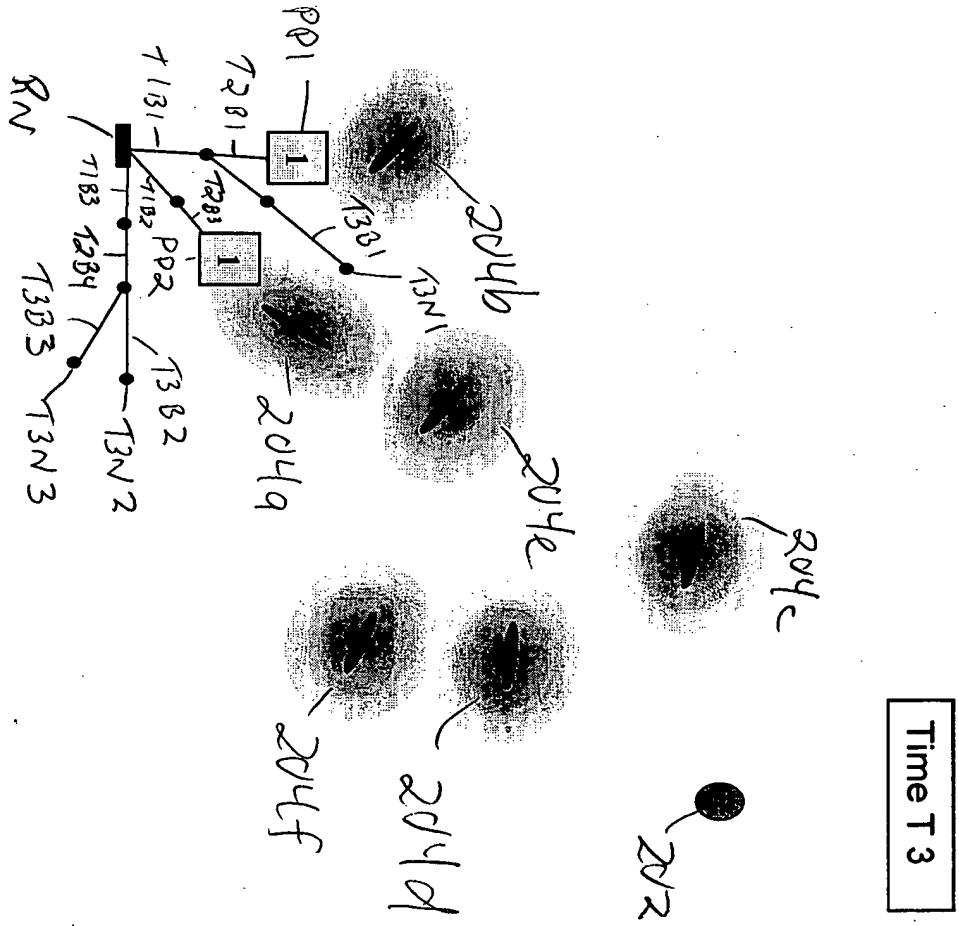

RN
T131
T181
T182
T183
T2B1
T2B2
T2B3
T2B4
T3B2
T3B3
T3N2
T3N3
PP1
PP2
1
1
1301
13N1
204b
204c
204d
204e
204f
204g
202
Time T 3

FIG. 2D

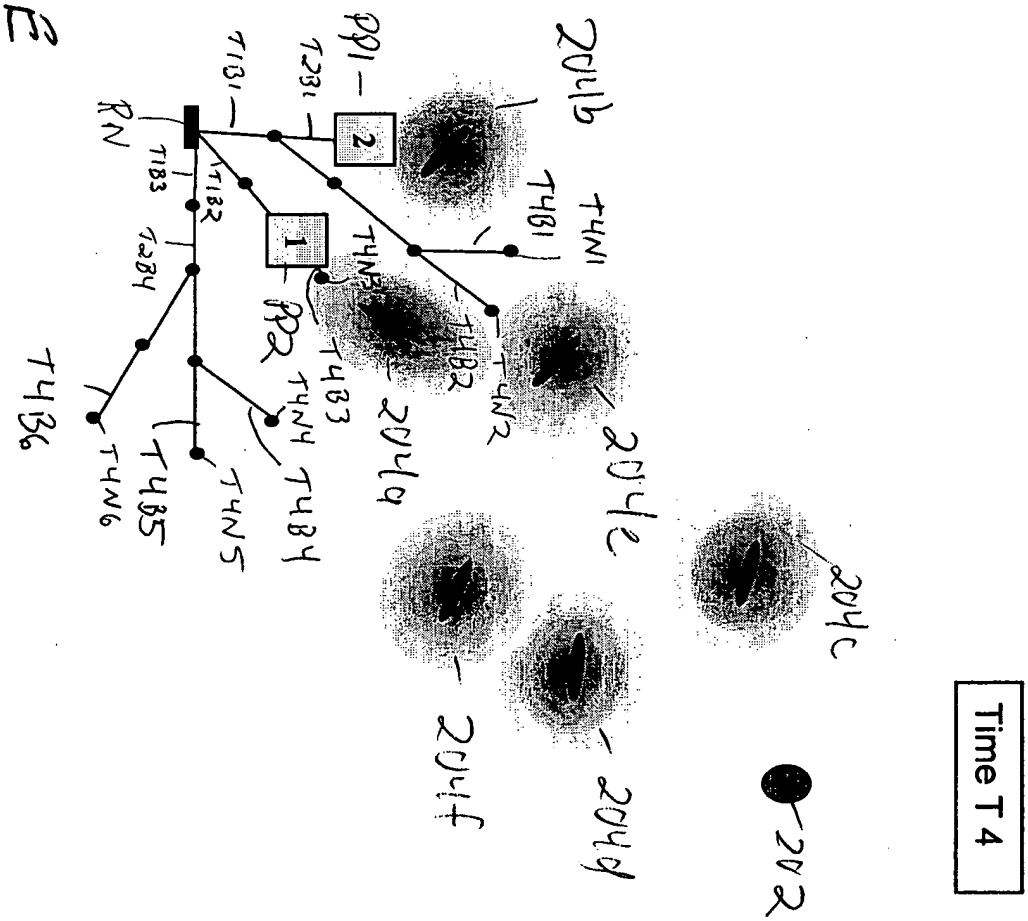

RN
T131
T231
T183
T182
T284
T136
T436
T485
T4N6
T4N5
T484
T4N4
T4B3
PR
PP1
2
1
T4N3
T4B2
T4N2
T4B1
T4N1
204b
204a
204e
204c
204d
204f
202
Time T 4

FIG. 2E

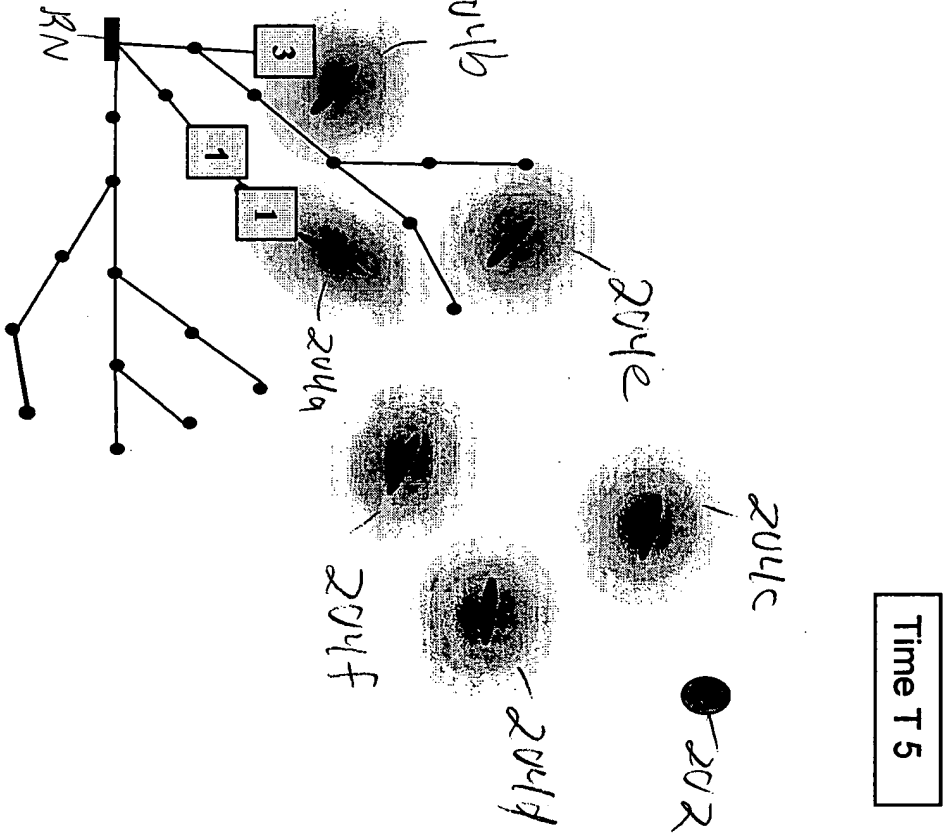


FIG. 2F

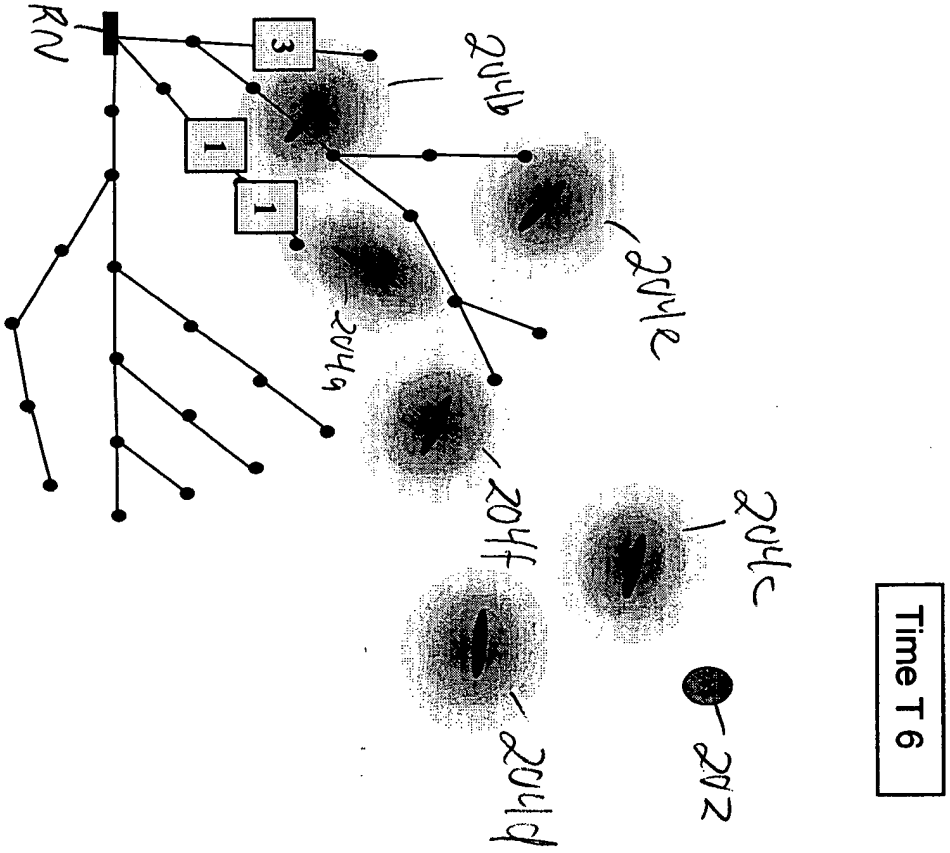


FIG. 2G

FIG. 21H

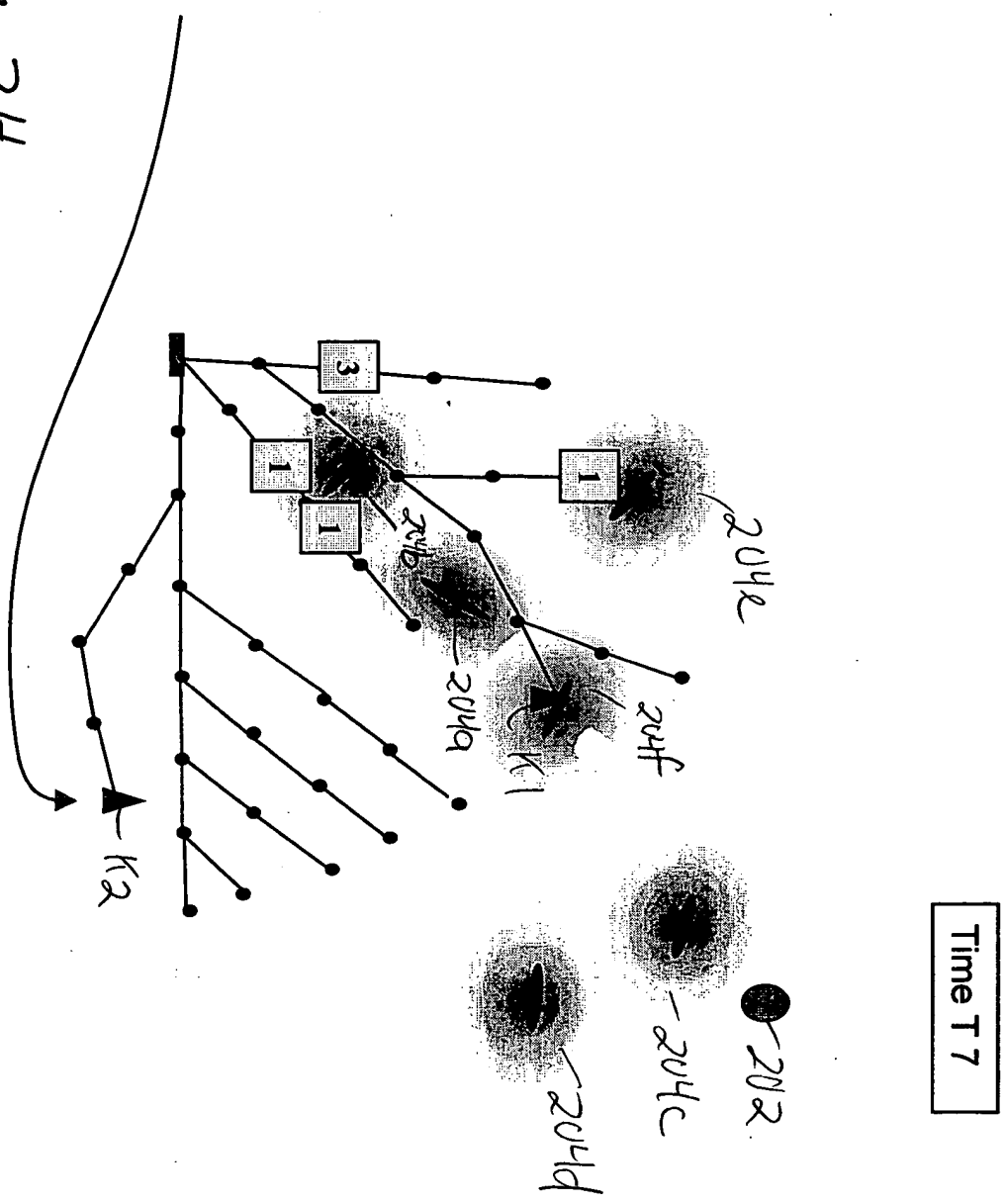


FIG. 2I

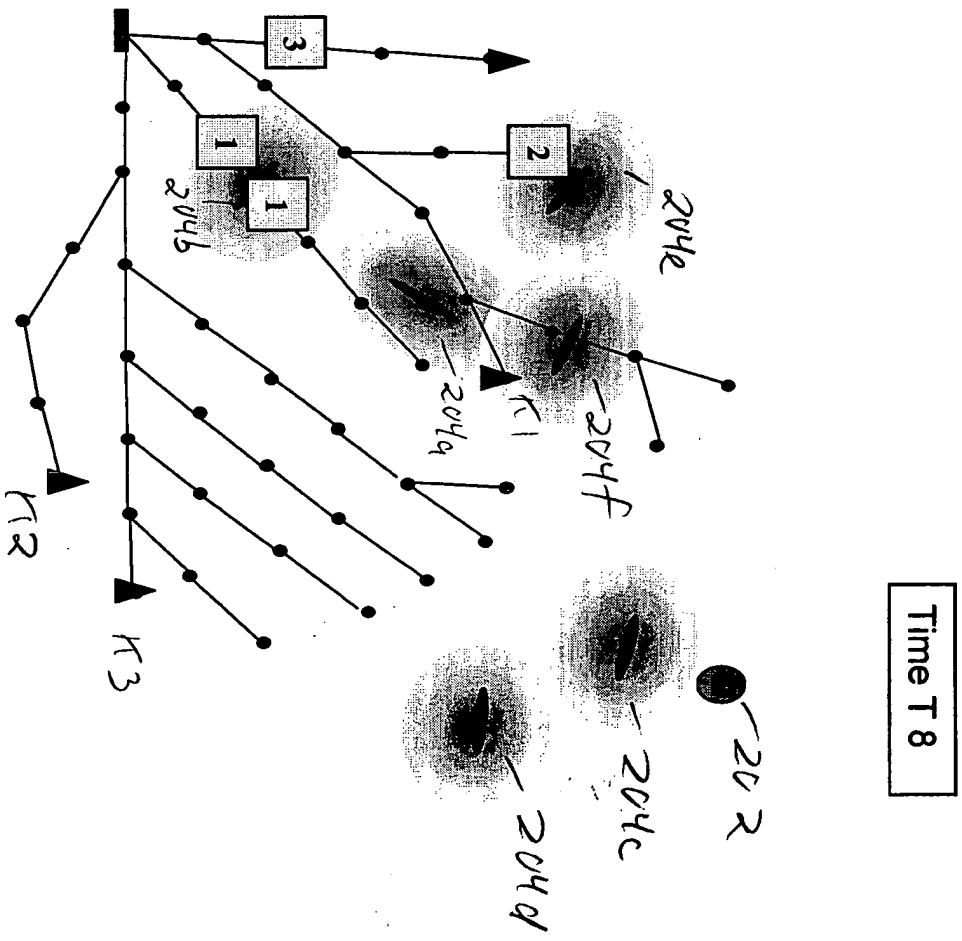


FIG. 2J

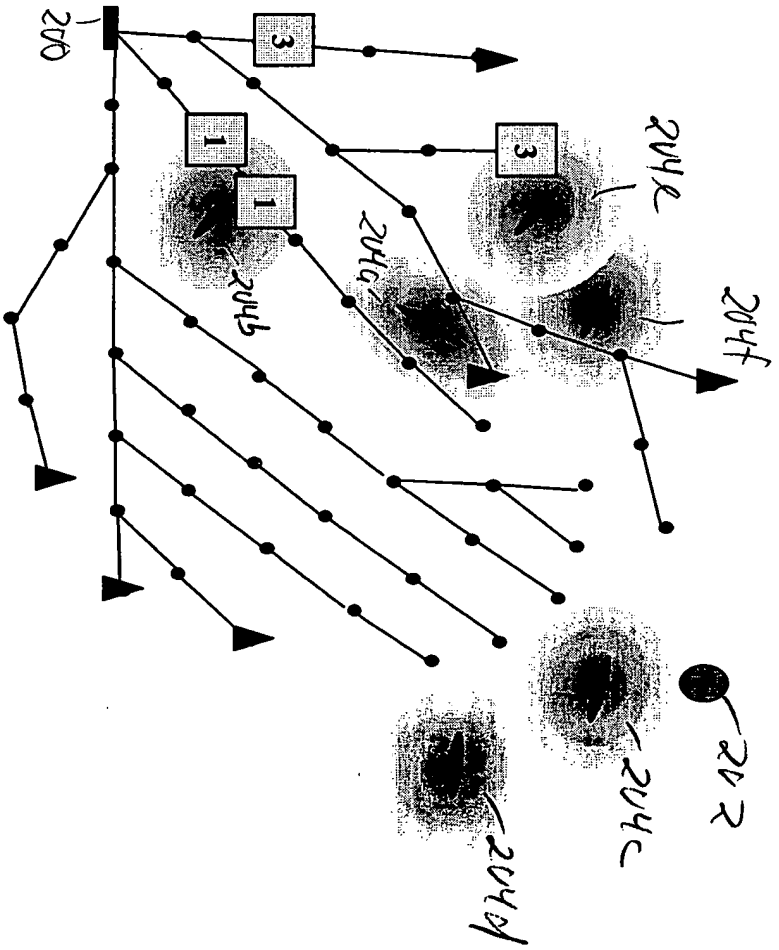


FIG. 2K

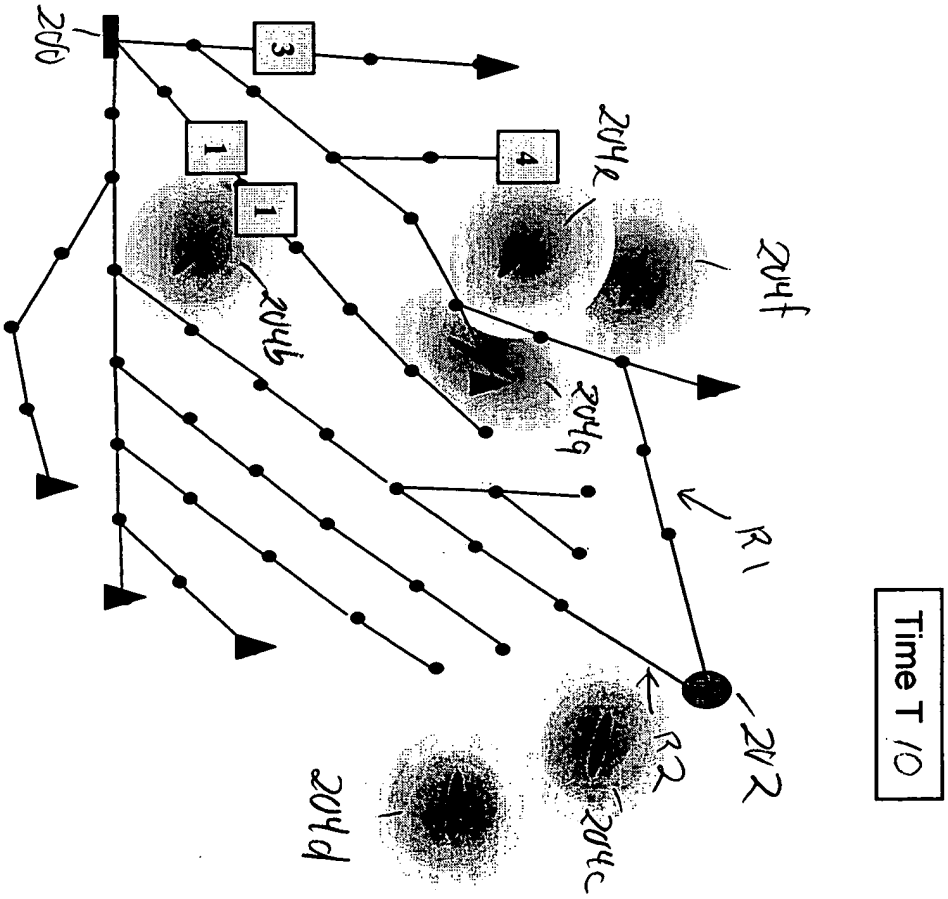
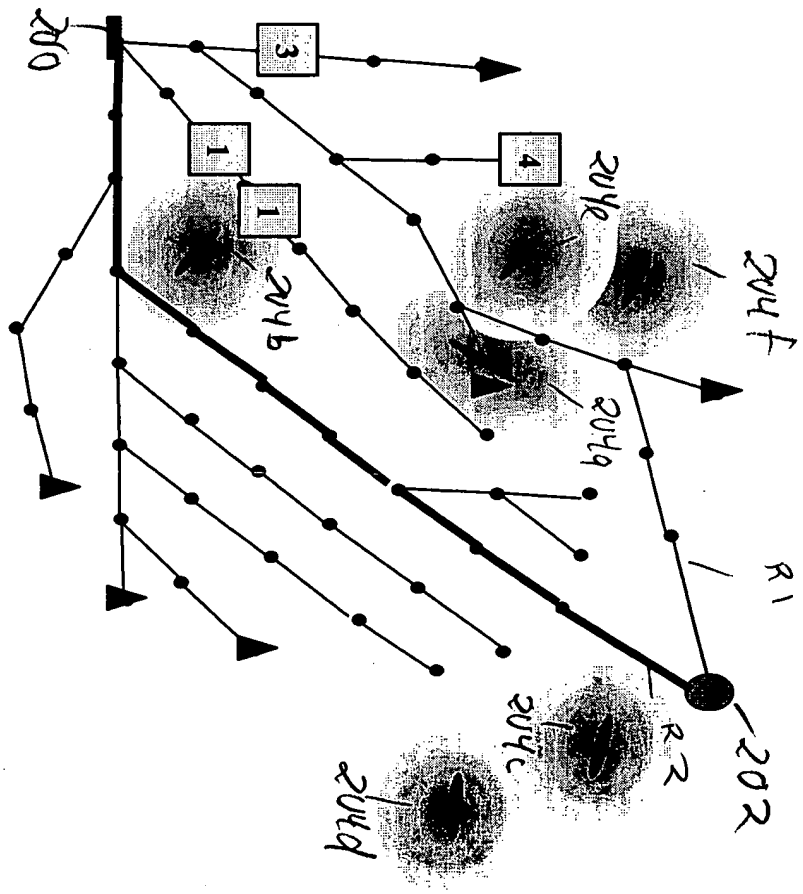


FIG. 2L



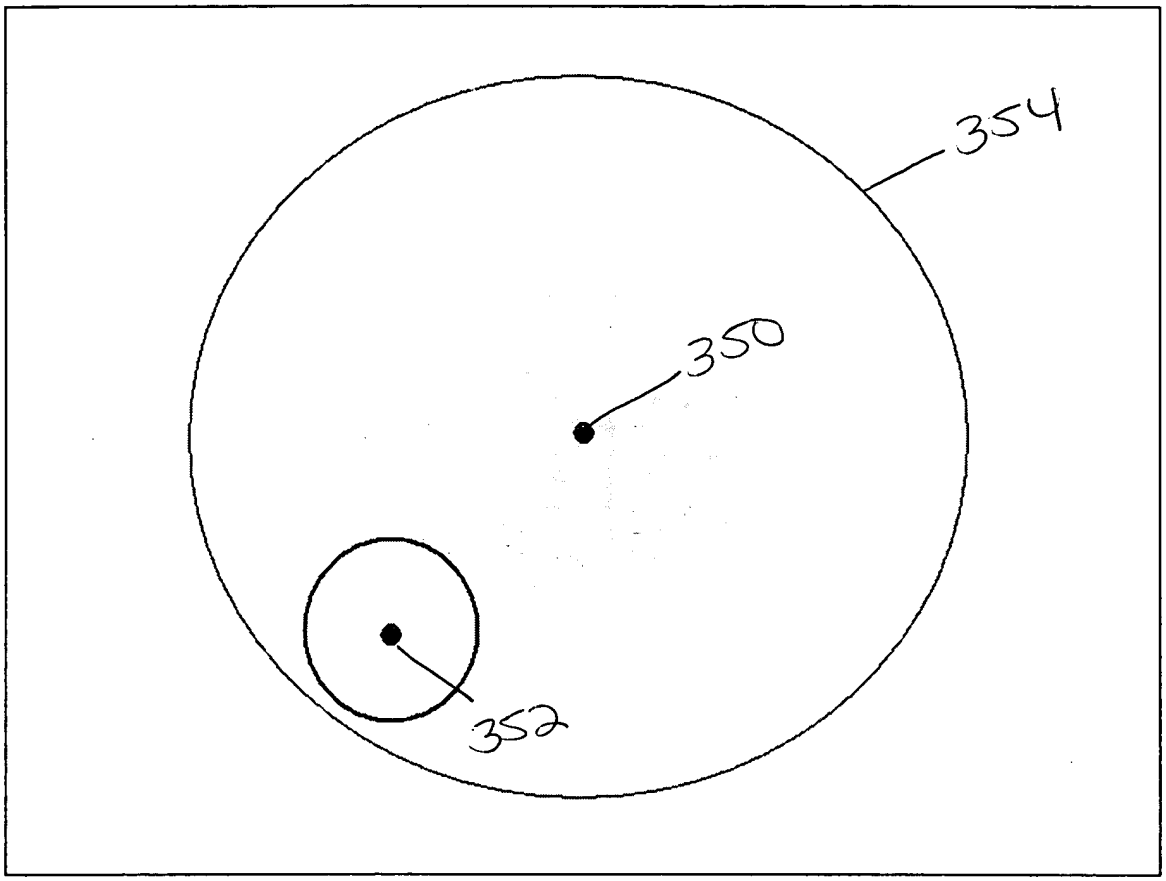


FIG 3A

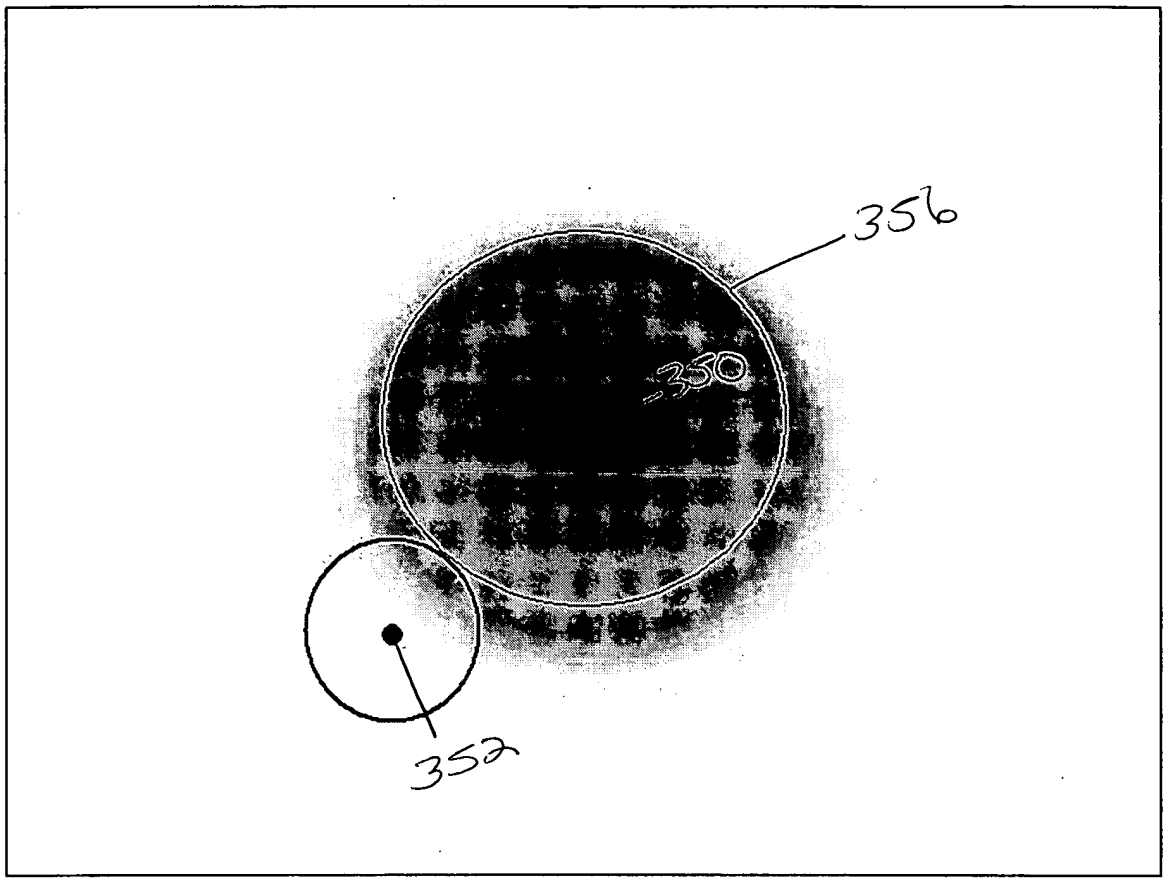


FIG 3B

400

WHILE the stopping conditions given by *Method Component 8* are not satisfied

DO *Deterministic Tree Extension.*

DO *Random Tree Extension.*

Set all leaf nodes that have not been extended in 3. or 4. to DEAD.

END WHILE

Deterministic Tree Extension

FOR each leaf node, N, that is not DEAD

Apply *Method Component 5* and obtain a set, X, of candidate path extensions to N.

FOR each candidate path extension, $\pi \in X$

Apply *Method Component 7* to determine if π is feasible.

IF π is feasible THEN extend N by π.

END FOR

END FOR

Random Tree Extension

WHILE *Method Component 5* says to continue random extension

Apply *Method Component 5* to obtain a set, Λ, of candidate nodes for random extension.

FOR each node, $N \in \Lambda$, apply *Method Components 5 and 6* to obtain a set, X, of candidate path extensions

to N.

FOR each candidate path extension, $\pi \in X$

Apply *Method Component 7* to determine if π is feasible.

IF π is feasible THEN extend N by π.

END FOR

END WHILE

FIG. 4

300

1. Add the root node at your current position to *T*;
2. Obtain the current ***Turn Wedge*** from the ***VMM***;
3. FOR each of #*SN* directions determined by discrete uniform distribution in the ***Turn***
   Wedge, attempt to extend in the direction;
4. END FOR;
5. IF it is not possible to extend in all #*SN* directions
6. THEN chose at most #*RA* random directions within the ***Turn Wedge*** and attempt
   to extend in these directions until #*SN* extensions have been attained;
7. END IF;
8. WHILE (***Stop Flag*** = = FALSE)
   Set ***Active Leaf List*** = ***New Leaf List***;
   Set ***New Leaf List*** to Empty;
   FOR each ***Active*** leaf node, *N*, in *T*
   Attempt to extend straight ahead from *N*;
   Attempt to extend towards the goal from *N*;
   END FOR;
   FOR each of the, at most, #*RN* ***Active*** leaf nodes having the best ***NM***
   Obtain the current ***Turn Wedge*** from the ***VMM***;
   Choose #*RE* random directions within the ***Turn Wedge*** and attempt to extend in each of these directions;
   IF it is not possible to extend in all #*RE* directions
   THEN chose at most #*RA* random directions within the ***Turn Wedge*** and attempt to extend in these directions until #*RE* extensions have been attained;
   END IF;
   END FOR;
   IF the ***Stop Condition*** has been met
   Set ***Stop Flag*** = TRUE;
   END WHILE;

FIG. 5

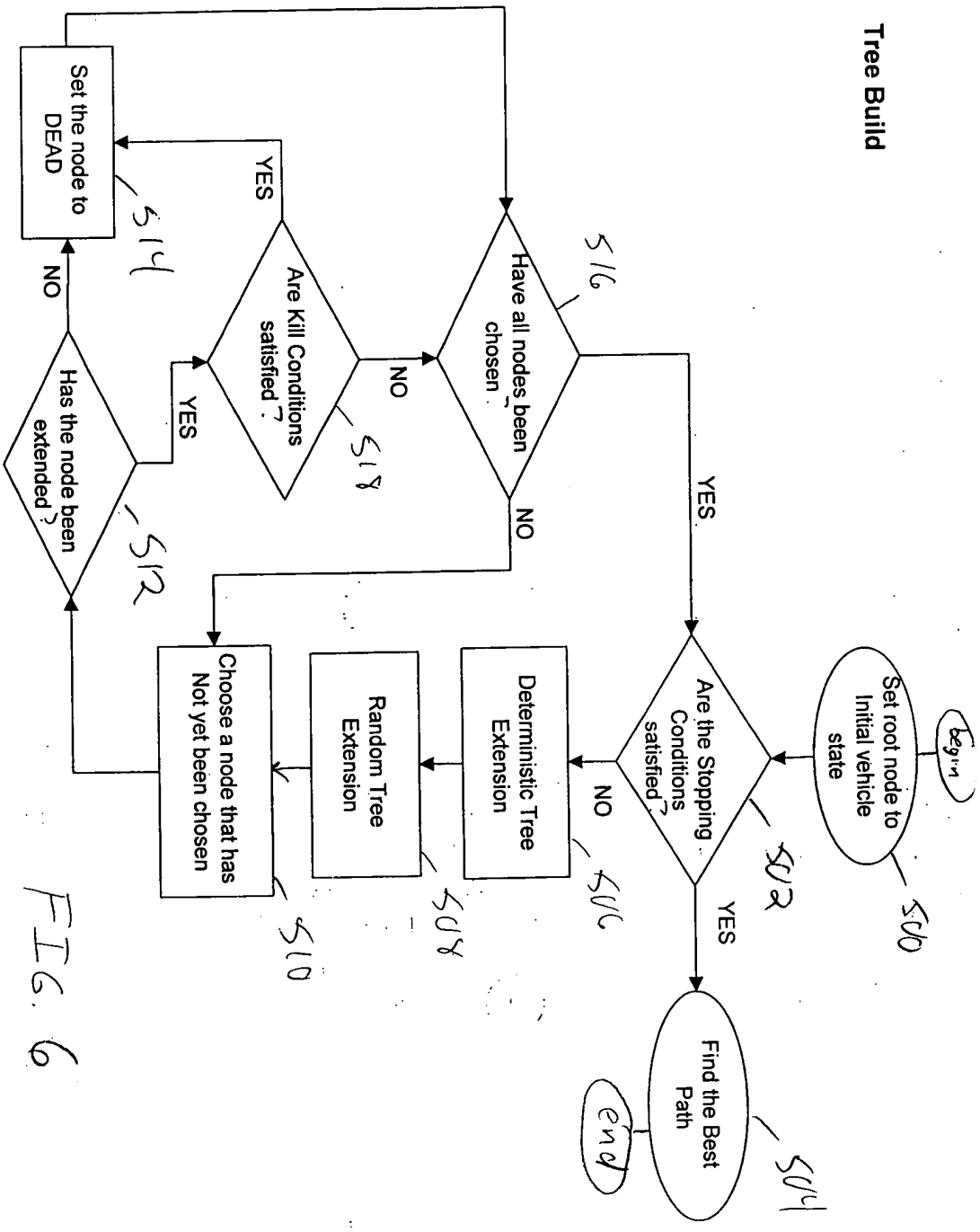

Tree Build
Begin
Set root node to Initial vehicle state
500
Are the Stopping Conditions satisfied?
502
YES
Find the Best Path
504
End
NO
Deterministic Tree Extension
506
Random Tree Extension
508
Choose a node that has Not yet been chosen
510
Have all nodes been chosen?
516
YES
Are Kill Conditions satisfied?
518
YES
Set the node to DEAD
514
NO
Has the node been extended?
512
YES
NO

FIG. 6

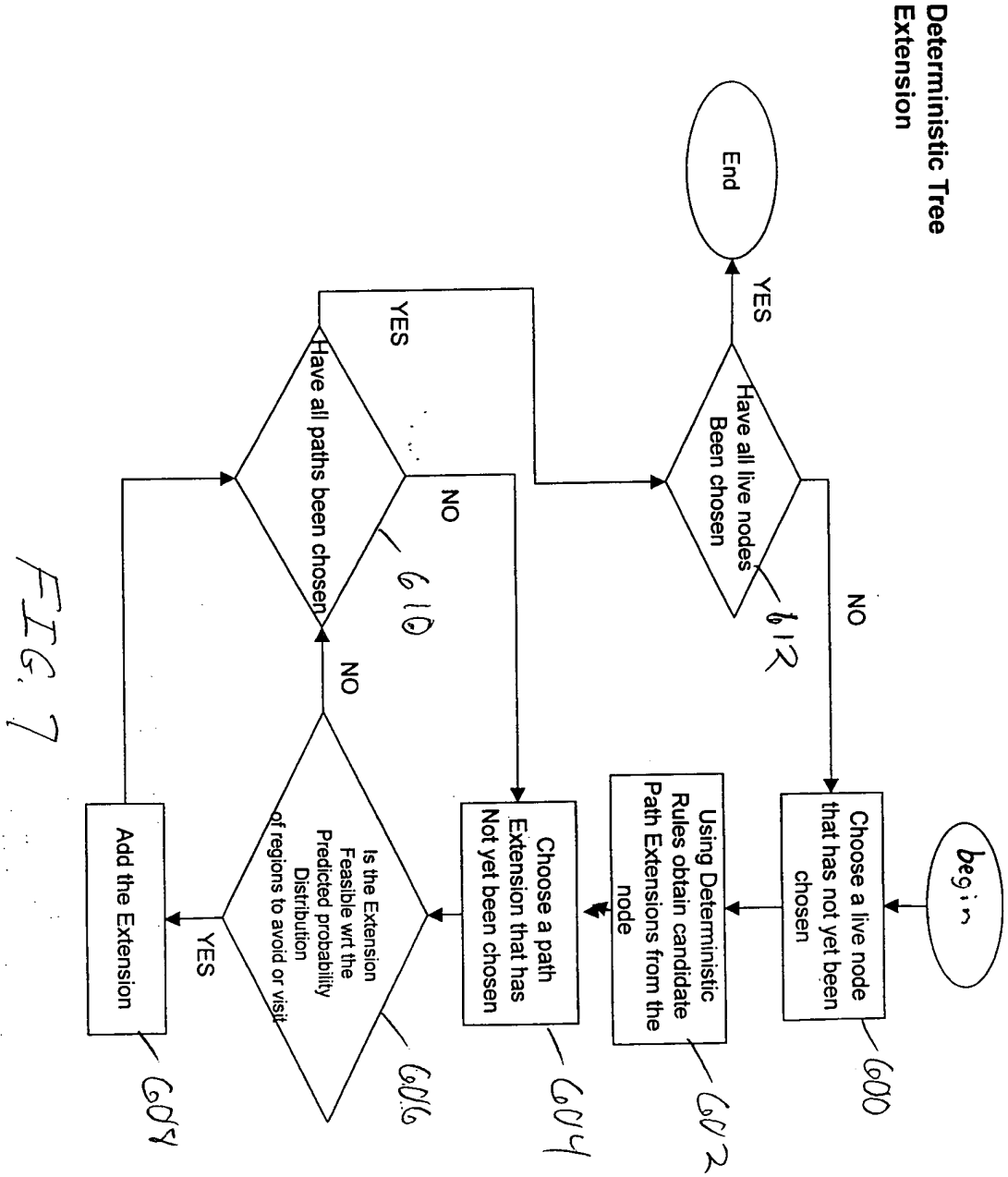

Deterministic Tree Extension
begin
Choose a live node that has not yet been chosen
600
Using Deterministic Rules obtain candidate Path Extensions from the node
602
Choose a path Extension that has Not yet been chosen
604
Is the Extension Feasible wrt the Predicted probability Distribution of regions to avoid or visit
606
Add the Extension
608
Have all paths been chosen
610
Have all live nodes Been chosen
612
End
YES
NO
YES
NO
YES
NO

FIG. 7

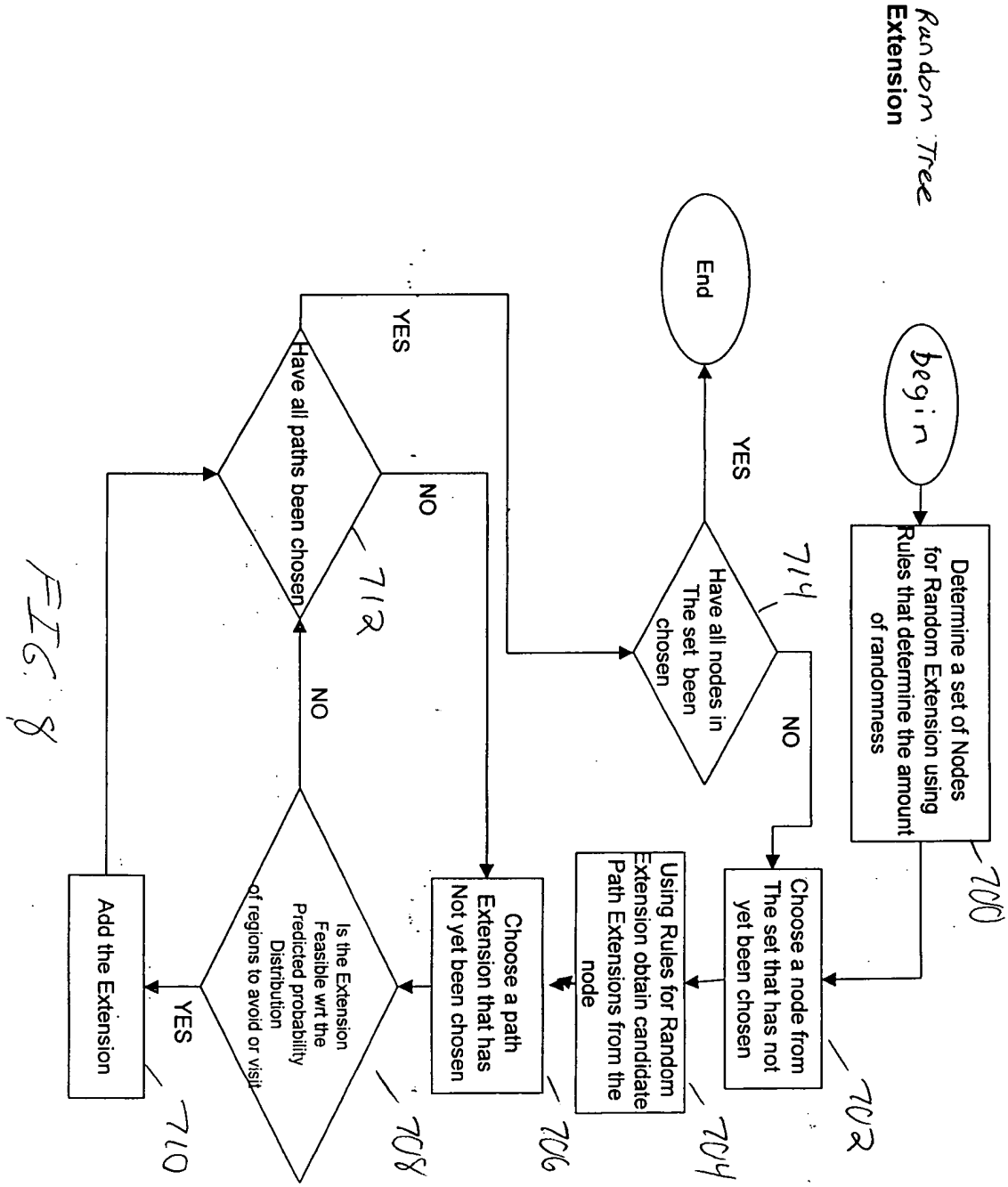

Random Tree Extension
begin
Determine a set of Nodes for Random Extension using Rules that determine the amount of randomness
700
Choose a node from The set that has not yet been chosen
702
Using Rules for Random Extension obtain candidate Path Extensions from the node
704
Choose a path Extension that has Not yet been chosen
706
Is the Extension Feasible wrt the Predicted probability Distribution of regions to avoid or visit
708
Add the Extension
710
Have all paths been chosen
712
Have all nodes in The set been chosen
714
YES
NO
End

FIG. 8

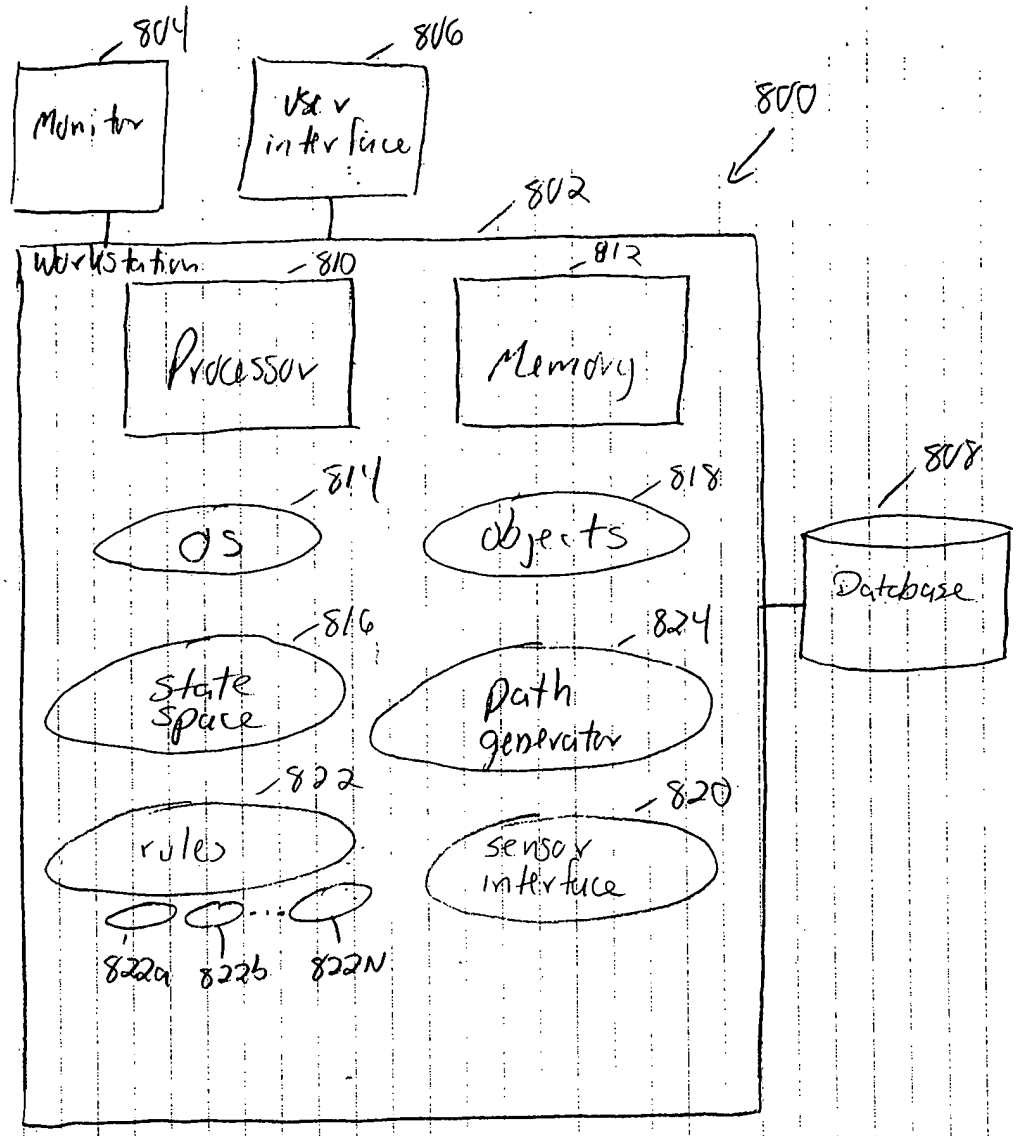

804
Monitor
806
User interface
800
802
Workstation
810
Processor
812
Memory
808
Database
814
OS
818
Objects
816
State Space
824
Path generator
822
rules
820
sensor interface
822a
822b
822N

FIG 9